Green Endoscopy

Vivek Kaul, MD, FACG[1]

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INTRODUCTION

Increasing recognition of the effects of climate change and the concern for environmental sustainability has spurred various industries to reassess their operations and develop strategies to reduce their carbon footprint. The field of healthcare contributes significantly to environmental degradation, primarily through the consumption of energy, production of waste, and emission of greenhouse gases. In response to these pressing concerns, the concept of green endoscopy has emerged in our specialty. This movement seeks to align stakeholders in an effort to reduce the environmental impact associated with endoscopic procedures.

CURRENT CARBON FOOTPRINT

Carbon footprint is defined as the total greenhouse gas emission caused by an individual, event, organization, or product and encompasses carbon emissions stemming from both energy consumption and waste disposal (1). Approximately 85% of greenhouse gases consist of carbon dioxide (CO_2) while the remaining portion is attributed to methane, nitrous oxide, and fluorinated gases, collectively known as carbon dioxide equivalents. Health care is a significant contributor to global carbon emissions, accounting for approximately 4.4% of the total carbon footprint (1). Healthcare emissions from the United States, United Kingdom, Canada, and Australia combined total approximately 748 million metric tons of CO_2 equivalents annually (2). Energy-intensive hospital operations (electricity, heating and cooling), increased use of disposables including personal protective equipment, staff travel, and transportation of products, and the production and disposal of supplies and equipment all contribute to this significant carbon footprint (3,4).

Gastroenterology is a very resource-intensive specialty, primarily due to endoscopy which is rated as the second highest, procedure-related waste-generating department in medicine and third highest waste-generating department in health care (1,3,5). Resource-heavy decontamination processes, complex waste streams, high-volume caseloads, nonrecyclable single-use consumables, and patient and staff travel all contribute to endoscopy's substantial carbon footprint (1,6). The utilization of personal protective equipment in endoscopy units has seen a substantial rise since the COVID-19 pandemic (7). The estimated total carbon cost of a standard esophagogastroduodenoscopy and colonoscopy is 5.43 and 6.71 kg of CO_2, respectively (8). The estimated endoscopy carbon footprint related to energy usage and plastic waste in the United States is 85,768 metric tons of CO_2 emissions annually, which is equivalent to the consumption of nearly 10 million gallons of gasoline, 93 million pounds of coal burned, and 212 million miles driven in a nonelectric car (1,9).

The potential for widespread adoption of single-use endoscopes has raised significant concerns regarding their environmental impact. While these disposable devices offer advantages in terms of infection control and convenience, their one-time use results in a substantial increase in medical waste generation (10,11). The manufacturing and disposal of single-use endoscopes contribute to resource depletion and escalate the carbon footprint of healthcare facilities. A recent study conducted a quantitative analysis to assess the environmental impact of transitioning from reusable to single-use endoscopic procedures. According to their findings, adopting single-use endoscopes could lead to a 40% increase in net waste and minimum 24-fold rise in CO_2 emissions while recognizing that reprocessing of reusable endoscopes (and devices) also contributes to the carbon footprint (12). Despite concerns around endoscopy-related infection, a recent systematic review revealed a low total endoscope-associated infection rate of 0.2% for reusable endoscopes (0.8% for endoscopic retrograde cholangiopancreatography, 0.123% for non-endoscopic retrograde cholangiopancreatography upper gastrointestinal [GI] procedures, and 0.073% for lower GI procedures) (13), Given this complex equation, efforts to enhance sustainability and reduce waste will require data-driven policies, judicious use of single-use devices, and development of alternative or innovative reprocessing technologies for reusable equipment and recycling of endoscopy unit waste.

STRATEGIES FOR GREENING OF ENDOSCOPY PRACTICE

Developing a sustainable endoscopic practice and transitioning to a green endoscopy unit requires a multifaceted approach that encompasses various aspects of patient care and facility management (Figure 1). This includes strategies that incorporate reusable endoscopes and accessories, minimize reusable device use during procedures, reduce waste generation through innovative reprocessing strategies, recycling materials when possible, using environment-friendly disinfection methods, and optimizing energy consumption in hospitals and endoscopy centers (5).

A key strategy for achieving sustainable endoscopy involves embracing the principle of the 3 R's—reduce, reuse, and recycle. To reduce waste, providers and endoscopy units should prioritize evidence-based practices and adhere to guidelines for endoscopy and surveillance algorithms. When clinically appropriate, performing bidirectional upper and lower endoscopy on the same day proves more resource efficient than scheduling these procedures on separate days (9). Refraining from performing unnecessary procedures, such as those without a clear indication (or borderline or low-yield indications), is an impactful initial strategy aimed to reduce the carbon footprint of endoscopy

[1]Segal-Watson Professor of Medicine, Center for Advanced Therapeutic Endoscopy, Division of Gastroenterology & Hepatology, University of Rochester Medical Center, Rochester, NY, USA. **Correspondence:** Vivek Kaul, MD, FACG. E-mail: vivek_kaul@urmc.rochester.edu.
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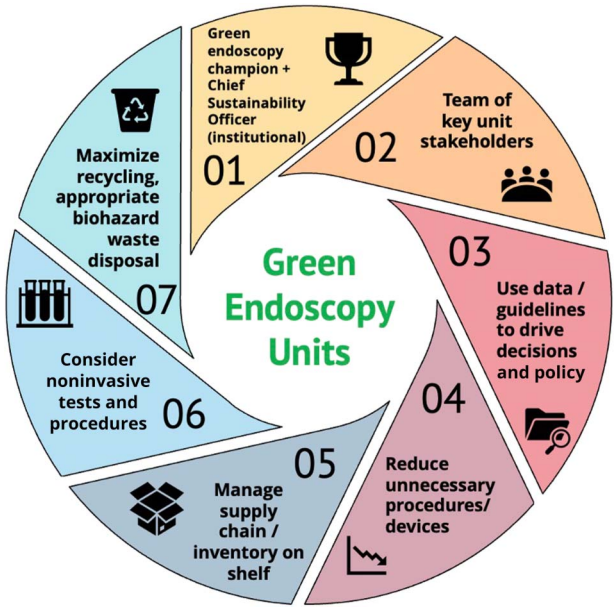

Figure 1. Practical tips for greening of GI endoscopy units. GI, gastrointestinal.

(9,14). Implementing such practices has the potential to make a substantial impact on the volume of waste generated, considering that studies indicate more than 50% of referrals for upper endoscopies and colonoscopies may be inappropriate (15,16). The concept of one-device colonoscopy, using a cold snare for removal of all lesions 1–10 mm in size, was recently shown in a prospective study to be feasible for most patients with noninvasive-appearing lesions and will help to reduce cost and plastic waste (17). In a 5-day period at 2 US academic medical centers, it was found that each endoscopy generated 2.1 kg of disposable waste with 64% of that going to landfill, 28% biohazard waste, and only 9% recycled (12). Another approach is to invoke noninvasive testing whenever possible. For some diagnostic indications, the use of noninvasive tests may help predict the diagnostic yield and necessity (or lack thereof) of endoscopy. For example, the use of serum and fecal biomarkers (serum C-reactive protein and fecal calprotectin) can be helpful to rule out inflammatory bowel disease in patients with irritable bowel symptoms and low clinical suspicion for inflammatory bowel disease (14,18). Recent findings indicate that noninvasive testing such as transient elastography in the absence of thrombocytopenia can rule out clinically significant portal hypertension. Consequently, endoscopy for assessment of varices may not be necessary in this specific subset of patients (9). Exploring alternatives to traditional endoscopy, like swallowable devices for Barrett's esophagus screening and surveillance, or innovative technologies, such as magnetically controlled capsule endoscopy and colon capsule endoscopy, can further minimize the need for endoscopy and reduce the environmental impact while answering the clinical question at hand (9,19,20). Efforts should also focus on waste reduction, by evaluating and optimizing supply chain management to minimize oversupply and expired materials on the shelf. Collaboration with industry with a focus on mutual environmental sustainability initiatives will be necessary and help propel this movement forward. The healthcare industry is already making significant investments on their part toward a carbon-neutral future, and our industry colleagues with expertise in sustainability initiatives can be a tremendous resource for gastroenterology practices, hospitals and endoscopy centers.

Adopting flexible work environments not only contributes to a reduction in greenhouse gas emissions due to decreased travel but also fosters a healthier work-life balance. This flexibility can be extended to both staff and providers, enabling them to complete administrative tasks and telemedicine consultations remotely. The COVID-19 pandemic expedited the utilization of telemedicine services, and data indicate that this consultative platform is both safe and efficient, with high rates of patient satisfaction (21–23).

At the level of the endoscopy unit, the establishment of a dedicated green team is crucial. This team should include representatives of administration, a passionate (and well-informed) green endoscopy champion, and other key team members with a shared interest in environmental sustainability (24). Together, this team can assess and understand existing waste handling protocols, energy consumption, and the use of disposable supplies within the endoscopy unit. They can pinpoint areas generating significant waste and, drawing from proposed initiatives, formulate effective strategies for improvement. Regular assessments of the impact of these changes should be conducted and adjustments made as necessary. In addition, the team can spearhead educational initiatives to raise awareness, initiate research and quality improvement projects, and foster interdisciplinary collaboration in this realm. Consideration should also be given to a green endoscopy unit-type designation or certification by a national society and/or health system, similar to the Endoscopy Unit Recognition Program that is in place under the auspices of the American Society for Gastrointestinal Endoscopy.

From a trainee standpoint, integrating simulation training, image libraries, and video recordings of live endoscopic procedures can contribute to a reduction in the number of live endoscopies required to attain competence in a specific procedure. Including simulation training in programs, particularly in the early stages of training, can be beneficial for skill development and proficiency (9).

Table 1. US GI multisociety (AASLD, ACG, AGA, ASGE) task force goals: areas of focus to achieve sustainability

Clinical practice
Education
Research
Intersociety activities
Intersociety collaboration
Industry
Advocacy

GI, gastrointestinal; AASLD, American Association for the Study of Liver Diseases; ACG, American College of Gastroenterology; AGA, American Gastroenterological Association; ASGE, American Society for Gastrointestinal Endoscopy.

CURRENT GUIDELINES AND NATIONAL SOCIETY EFFORTS

A multisociety task force including leadership from the 4 major US GI societies—the American Association for the Study of Liver Disease, the American College of Gastroenterology, the American Gastroenterological Association, and the American Society for Gastrointestinal Endoscopy—has recently outlined a 5-year joint

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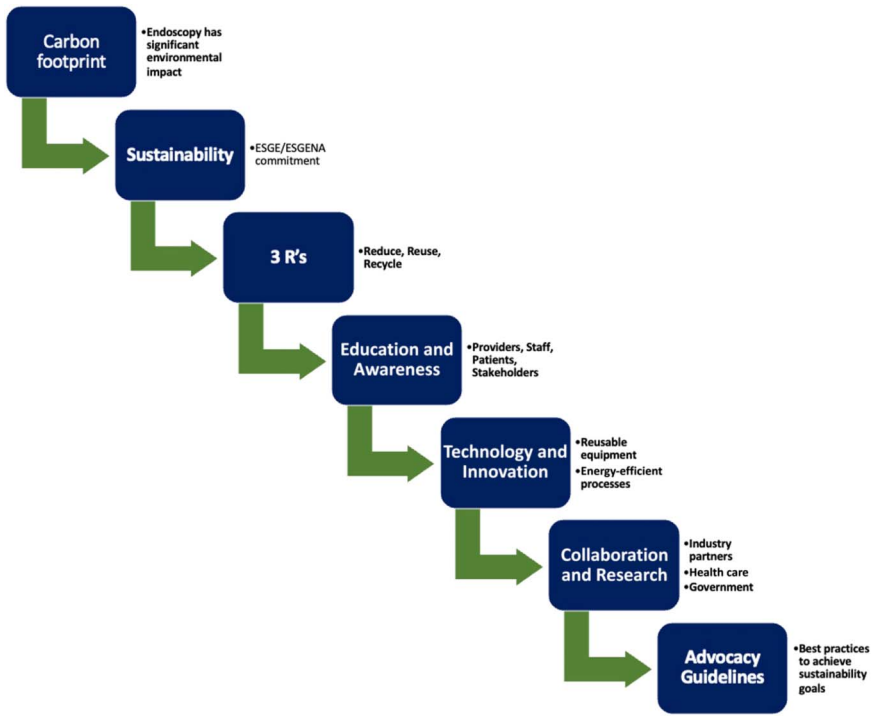

Figure 2. ESGE/ESGENA position statement. ESGE, European Society of Gastrointestinal Endoscopy; ESGENA, European Society of Gastroenterology and Endoscopy Nurses and Associates.

strategic plan to reduce the environmental impact of GI practices (Table 1) (25–28). In addition to providing a step-by-step guideline to assist practices in implementing changes toward sustainability, the 4 societies have also committed to assessing their own carbon footprint and reducing environmentally harmful activities at a societal level.

Similarly, the European Society of Gastrointestinal Endoscopy and the European Society of Gastroenterology and Endoscopy Nurses and Associates released a position statement raising awareness regarding the substantial environmental impact of endoscopy and also made recommendations for immediate and long-term changes to develop environmentally sustainable practices (Figure 2) (29). The World Gastroenterology Organisation Climate Change Working Group released recommendations to help guide the gastroenterology community toward more sustainable and environmentally responsible practices (Table 2). A recent global webinar series hosted by the World Gastroenterology Organisation Climate Change Working Group provided an in-depth, comprehensive review of several aspects pertinent to gastroenterology and climate change with inputs from a diverse group of stakeholders (30). The collaborative effort of the British Society of Gastroenterology, Joint Accreditation Group, and Centre for Sustainable Health was recently published in a joint consensus statement that outlines recommendations for sustainable practices in GI endoscopy (Table 3) (9).

The joint efforts of national and international societies, in partnership with industry and policymakers, will be paramount for the success of this transformational movement. Without meaningful policy and regulatory reform that leads to (and permits) change in corporate and clinical practices, it will be

Table 2. WGO Climate Change Workgroup recommendations

Raise awareness
Education and training
Advocacy and policy
Research and data collection
Resource optimization
Guidelines and best practices
Collaboration
Patient education
Continuous improvement
Global engagement

WGO, World Gastroenterology Organisation.

Table 3. BSG, JAG, and CSH joint consensus: practical tips for green endoscopy units

Clinically appropriate endoscopic procedures
Digitalize information
Renewable energy
Responsible purchasing
Innovative decontamination processes
Recycling
Green champions
Innovative training programs

BSG, British Society of Gastroenterology; CSH, Centre for Sustainable Health; JAG, Joint Accreditation Group.

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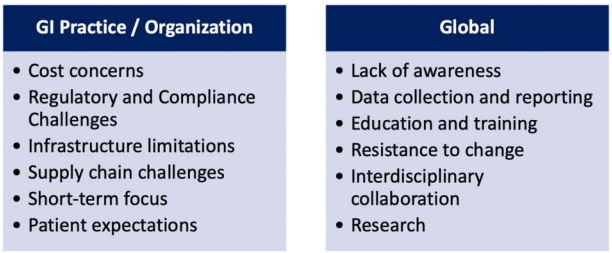

Figure 3. Barriers to adopting sustainable endoscopic procedures.

difficult to achieve the sustainability goals we desire in health care.

BARRIERS

There are several barriers to developing a green endoscopy unit (Figure 3). Some of these may be unique challenges in a particular health system, region, or patient population, but there are some common hurdles that have been identified universally. The first issue is a general lack of awareness of the impact of climate change and the concern for the significant carbon footprint of endoscopy. Without this in place, sustainability efforts may not emerge as a priority for a health system, practice, or provider. There may also be resistance to change, established routines, and practices based on lack of knowledge about innovative sustainability practices and concern about the need to adhere to rigid regulatory guidelines. Consistent education and training on sustainable practices for all stakeholders will be important for success going forward. In addition, incorporating a dedicated training session into onboarding programs for physicians and endoscopy unit staff will help raise awareness of the concern and the need for participation and collaboration to make a meaningful reduction in the carbon footprint in the endoscopy unit.

Healthcare systems may also have concerns regarding the cost of implementing green initiatives, particularly when there is a need to invest in new capital equipment or implement new processes. Entities may have a difficult time identifying sustainable and cost-effective alternatives for medical equipment and devices from their current supply chains or there may be issues with proposed changes from a regulatory and compliance standpoint. Finally, there may be some reluctance from patients based on their expectations and preferences.

A focus on interdisciplinary collaboration across different departments within a healthcare organization, nationally and internationally, may take time and effort but ultimately can help demonstrate the benefits of implementing sustainable changes and gain support for green initiatives.

FUTURE DIRECTIONS

Engagement of healthcare providers across all roles, including gastroenterologists, trainees, advanced practice providers, endoscopy nurses, and support staff, will be essential for championing green endoscopy. Advocacy within the medical community, along with the development of comprehensive education and training programs, will play a pivotal role in raising awareness and fostering the adoption of environment-friendly practices. Collaboration with industry partners and national/international societies is essential to standardize sustainable practices, promote joint initiatives, and support ongoing research in this field. As existing endoscopy units undergo renovation and new units are designed, sustainability plans should be incorporated, encompassing decontamination processes, water resources, energy-efficient lighting, and renewable energy resources (9).

Meaningful and transparent investigation to better understand the current environmental impact of endoscopy practice and the long-term effects of proposed sustainability changes is needed. This can guide and reassure all stakeholders involved in this movement, ensuring that changes are balanced with infection control principles and do not compromise patient safety outcomes.

CONCLUSION

There is a pressing need for healthcare systems and specialties like gastroenterology to adopt environmentally sustainable practices and align with global efforts to reduce the negative impact of climate change. On the global scale, professional societies and governments have made a commitment to address and reduce this environmental impact, making sustainability a central strategic goal in policy and research. Healthcare professionals also play an important role in advocating and leading change to develop more sustainable practices. Some of the latest concepts and best practices in this regard have been highlighted in this review, with a focus on the GI endoscopy unit. By embracing these strategies individually and collectively, gastroenterologists can start contributing significantly to the greening of our endoscopy units, one unit at a time.

CONFLICTS OF INTEREST

Guarantor of the article: Vivek Kaul, MD, FACG.
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Potential competing interests: None to report.

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